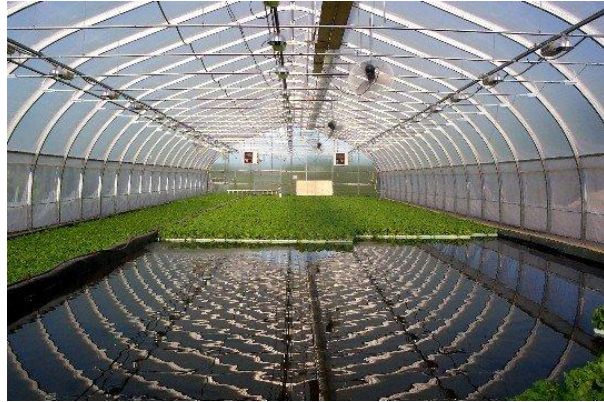


**GroEco**

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## The Greenhouse or Commercial Grow Structures used today



Greenhouses are the most common types of structures used for production of vegetable crops under some controlled conditions. Most greenhouses are made from sheets of plastic stretched over a metal frame. The structures provide the potential to control environmental parameters, although to varying degrees depending upon the design of the structure and its components and location.



Commercial grow structures are in existing buildings, roof tops and most still rely on the sun. The location of these structures in most cases was determined on the climate in those areas.



GroEco has teamed up with Laki Technologies on a new structure for growing in a clean and controlled environment. GroEco is growing indoors today in a very clean controlled environment 24 - 7 - 365 a year. With our new efficient grow lights to our new nutrient's growing any time of product has been made easy. The structures from a small grow facility to very large grow farms that can be placed in hot or cold regions without compromising growing and costs.

GroEco is a sustainable agriculture business that utilizes innovative production systems which include but is not limited to aquaponics and hydroponics. Along with our growing systems, GroEco also employs the newest automated indoor growing facility, which enables year-round, all natural, nutrient rich fruit, vegetables to flowers production. Along with produce, our systems can support the simultaneous production of fish to ells. We grow in a bio-secure environment to minimize the introduction of pests and pathogens within our growing facilities. The climate can be controlled based on optimum temperature requirements of fish and plant species; thus, enabling maximum production. We also utilize full spectrum, low heat to low energy LED lighting to maximize growth cycles and plant production. We are concerned about the integrity of our planet and utilize sustainable practices to conserve water, land, and energy.

<sup>1</sup>**Aquaponics:** The amalgamation of aquaculture and hydroponics in an enclosed symbiotic environment.

<sup>2</sup>**Hydroponics:** The production of plants in a nutrient rich solution without soil.

<sup>3</sup>**Aquaculture:** The production or farming of fresh and saltwater organisms.

With an ever-growing human population and a planet that is struggling to support demand, GroEco is committed to providing sustainable, all natural, nutrient rich crops



from corn, peppers, microgreens to bananas.



Other products: include but are not limited to:

- Leafy Greens - lettuce, spinach, kale
- Culinary herbs - basil, cilantro, and parsley
- Fruiting Crops - tomatoes, strawberries, and cantaloupe
- Fish - tilapia,
- Floriculture (flowers) - edible and seasonal/holiday flowers



Medical hemp farm in Colorado, GroEco 's lights lowered their power bill over 60% and they received a credit over \$140,000 from the power company.



Controlled test indoors: Both samples were from the same group of seeds and started on January 12, 2018. The plants on the left was grown in soil using fertilizer and pesticide to control diseases and bugs under normal grow lights used today. The plants on the right were grown in water with no pesticides and with GroEco 's new grow lights and nutrients. The plants were put into soil for three days with no affects from the transfer from water to soil (photos above were taken on February 12, 2018). The plants were in soil for 7 days and then put back into water with no affects to the plant.



The hemp plant above was grow in water from seed on January 12, 2018 and the photo was taken on March 9, 2018.

## GroEco large grow farms

The new structure will be able to control the environment for best plant production with sufficient light, temperature and humidity. The structure can go into hot or cold regions without compromising the product to be grown. The structure is a bio-secure environment.



Prior to entering into the grow area, each technician and worker will go through a clean room.



The grow facility is a bio-secure environment, medical and other experiments can be done in this facility.



Flowers can be planted on set dates and ready to be harvested to meet the orders for that special Mother's Day.



The vegetable can be grown year-round as well. Being close the cities allows the grocers to have fresh produce at their door step every day.



Fish processing and freezer facility.



Honey bees will be kept on site to pollinate plants.

## Aquaponics water usage



### Aquaponics water usage

How does the water usage compare to other means of raising fish and plants? The amount of water used is significantly smaller. Believe it or not, Aquaponics water usage is only 5% (or even less) than what used in conventional techniques.

**In aquaculture**, fish waste increases levels of ammonia, nitrite and nitrate in the water. Even with expensive filtration systems, the water has to be replaced regularly. This waste water will be dumped into the environment and can contain unwanted levels of these chemicals.

**In hydroponics**, nutrient chemicals are added to the water manually. Eventually, the levels of the nutrients will become too out of balance and the water will be replaced with fresh water. The water in the system will then be disposed of in the environment.



### **Aquaponics is a closed-loop system**

The Aquaponics water usage is incredibly low, no water is wasted as the system is designed in such a way that it is always in balance. Nutrient rich waste water from the fish tank is transformed by good bacteria into nutrients that the plants thrive on. The water flows to the plant beds (where good bacteria also convert fish waste into plant nutrients) and the plants use

these nutrients to grow. The water is thus filtered. The filtered, cleaned water is then returned to the fish tank. This cycle can be continued forever, without wasting water. Aquaponics is thus truly a closed-loop system. Both fish and plants are produced in a single system with an absolute minimum of water usage.

### **Water usage comparison - Fish**

When raising fish in an Aquaponics system, little or no water is wasted as the plant beds continually filter out the waste as their nutrients and the water can be reused for the fish tank. See the table below just how big this difference can be compared to other methods of raising fish.

Open water net pens	No additional water is used, but precious open water space is used for raising fish and care has to be taken that the environment can sustainably handle the fish waste produced by open-water net pen operations.
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Non recirculating raceways and tanks 5.000 - 10.000 gallons per pound of production.

Non recirculating ponds	500-1.000 gallons per pound of production
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Recirculating systems	5-10 gallons per pound of production
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<b>Integrated Aquaponics</b>	<b>Water is reused by the plants and returned to the fish tank.</b>
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### **Water usage comparison - Plants**

The difference in water usage for watering the plants in an Aquaponics system or hydroponics system is absolutely stunning. With a large margin of safety, water usage is less than 5% compared to traditional forms of gardening. Imagine the consequences of this in dry regions! As

a benefit, the nutrients are kept in the system. In conventional gardening, irrigation will wash the soluble nutrients down, and out of reach of your crop. In Aquaponics, this is not possible.

## **This Is How Much Water It Takes to Make Your Favorite Foods**

Extensive drought has Californians thinking twice about running the tap while brushing their teeth or taking that 20-minute shower. But what some people don't realize is that a huge portion of our water footprint is "hidden," meaning it's used for the things we eat or wear, and for the energy we use. Globally, agricultural production accounts for 92 percent of our water footprint. In the United States, meat consumption alone accounts for a whopping 30 percent of our water footprint.

So exactly how much water do the foods you eat require? Which food would win in a water use showdown? We've got the answers below, along with some helpful hints about reducing the water footprint of your diet.

All data come from Water Footprint Network's website and reports on the global average water footprint of different foods. All winners are based on the gallons of water needed to produce a pound of each item or a gallon of each drink.

## Tofu vs. Lentils



**Winner:** Tofu at 302 gal./lb. It takes 704 gallons of water to produce one pound of lentils. Chickpeas require less than lentils at 501 gal./lb., and soybeans require less than the more processed tofu, at 257 gal./lb. All of these options are better than eating beef, sheep or pork.

Some will argue that the measurement of gallons per pound isn't fair -- we should consider water consumed per gram of protein. In this case, pulses (including beans, lentils, peas, etc.) win out at 5 gallons per gram of protein, followed by eggs at 7.7 gal./gram, milk at 8.2 gal./gram, and chicken at 9 gal./gram. The numbers only go up from there, with beef topping the scale, requiring 29.6 gallons of water per gram of protein.

## Tea vs. Coffee



**Winner:** Tea is the winner at 108 gallons of water per gallon of brewed tea. Coffee requires almost 10 times as much water, using 1,056 gallons of water per gallon of brewed coffee.

## Wine vs. Beer



**Winner:** Beer at 296 gallons of water per gallon of beer. It takes 872 gallons of water to produce 1 gallon of wine. But if you look at standard servings of each, the race gets closer with about 28 gallons of water needed for 12 fluid ounces of beer and 34 gallons of water needed for 5 fluid ounces of wine.

## Beef vs. Chicken



**Winner:** Chicken at 518 gallons of water per pound. Beef requires the most water, at 1,847 gal./lb., followed by sheep at 1,248 gal./lb. and pork at 718 gal./lb. If you're going to eat meat, go with chicken. Better yet try eggs, which take 395 gal./lb., or plant-based protein. For dairy

products, cheese and butter take more than milk at 381 gal./lb. and 665 gal./lb. respectively. Milk by itself uses only 122 gallons of water per pound.

### Oats vs. Potatoes



**Winner:** Unprocessed potatoes at 34 gal./lb. It takes 290 gallons of water to produce one pound of rolled or flaked oats. Sweet potatoes also take less water, using 46 gal./lb., while unprocessed corn requires 146 gal./lb.

### Hazelnuts and Walnuts vs. Almonds and Cashews



**Winner:** Hazelnuts and walnuts at 1,260 gal./lb. and 1,112 gal./lb. respectively. That's still a lot of water! But almonds and cashews take more, averaging 1,929 gal./lb. and 1,704 gal./lb. It takes 1,362 gallons of water to produce one pound of pistachios

## Figs vs. Raisins and Dates



**Winner:** Raisins and dates at 292 gal./lb. and 273 gal./lb. respectively, though all three of these take more water than most fruits. Figs require the most -- producing one pound of figs requires 401 gallons of water.

## Stone Fruit vs. Citrus



**Winner:** Citrus, at 67 gal./lb. for oranges, 61 gal./lb. for grapefruit and 77 gal./lb. for lemons. Plums require 261 gal./lb., apricots 154 gal./lb. and peaches 109 gal./lb. Avocados are also higher on the list at 141 gal./lb., while apples, bananas, grapes, and kiwis all take less than 100 gal./lb. Strawberries, pineapple, and watermelon require less than 50 gallons of water per pound of fruit.

## Broccoli vs. Asparagus



**Winner:** Broccoli at a scant 34 gal./lb., along with cauliflower and Brussel sprouts. Asparagus is the water hog of the veggies, requiring 258 gallons of water per pound

## Olives vs. Garlic



**Winner:** Garlic at 71 gal./lb. Olives require 361 gal./lb.

## Tomato vs. Eggplant



**Winner:** Tomato at 26 gal./lb. Eggplant requires a still quite low 43 gal./lb. Artichokes cucumbers, and lettuce require 98 gal./lb., 42 gal./lb. and 28 gal./lb., respectively.

Though we've shown them here to illustrate how much water vegetable farming uses, there really are few losers when it comes to veggies. In general, they consume far less water than animal products, nuts and grains.

## Olive Oil vs. Corn, Sunflower and Soybean Oil



**Winner:** Everything beats olive oil, which requires 1,729 of water per pound to produce. That's more than all oils except castor oil. Corn oil takes 309 gal./lb., sunflower 814 gal./lb. and

soybean 502 gal./lb. If you're a fan of coconut oil you're in luck, as it is also relatively low on the scale. One pound requires 538 gallons of water.

### Chocolate vs. Vanilla



**Winner:** Chocolate at 2,061 gal./lb., but this sadly still takes more water to produce than beef. Though we doubt you'll be eating a pound of chocolate any time soon. Cocoa powder takes 1,874 gal./lb. Vanilla beans top the charts at 15,159 gal./lb., though they are usually used in very small quantities.

### Cinnamon vs. Mint



**Winner:** Peppermint wins, taking only 35 gallons of water to produce one pound. One pound of cinnamon requires 1,860 gallons. Ginger requires 199 gal./lb.

Remember, what's important here is recognizing that our food makes up a big part of our water footprint. In fact, general trends are more illustrative than knowing exactly which foods have the lowest numbers. Eating fewer animal products and more plant products will reduce your water footprint, as will eating less-processed foods. For example, **potato chips** have more than three times the water footprint of potatoes, and ketchup takes twice as much as tomatoes. The same is also true of grains and dairy products -- milk is far less water intense than cheese and butter.

Of course, these measurements are by pound, and we think it's unlikely you would consume the same weight in ketchup as you would whole tomatoes. The Water Footprint Network **also suggests** choosing high water intensity products that are grown or produced in areas that do not have water scarcity problems, if making changes to your diet proves difficult

## California Drought (real article, pictures were added)



The California drought has officially gotten scary. **Further complicating the situation** is the fact that almost **80% of California's water supply goes to the state's agriculture needs**, which in turn goes toward feeding the entire planet. (Did you know that California produces 80% of *the world's* almonds?) A recent LA Times infographic shows just how much water is used to produce one plate of food (968 gallons). There is also an interactive version, where **you can create different plates of food to understand their water impact**



Infographics like this can feel at once illuminating and confusing, so we thought we'd take this opportunity to identify and discuss some of the major takeaways. **First, we can see that the biggest water-hog on the plate is the eight-ounce steak, which requires 850 of those 968 gallons of water to produce.** Why does meat need so much water? Well, it has to do with the way we feed our livestock. When meat comes from industrial feedlots, the water is fed through irrigation systems used to sustain the animals' grain-based diet (mostly soy and corn). Less water is used for grass-fed and grass-finished beef, which relies on Mother Nature: rain and pasturing.

Why are we telling you this? Well, because the **American consumption of beef is more than 37 million tons annually**. That's the highest in the world, and that means our water needs are higher, **which has a direct impact on this drought**.

So, what can you do? Honestly (and you're probably not going to want to hear this), **the very best thing we can do is cut our consumption of meat**. Don't kill the messenger, friends! Listen, if cutting out meat entirely or dramatically decreasing your consumption sounds impossible, consider starting with a Meatless Monday.



**If you are going to eat meat, then your best choice is chicken**, which only requires 17 gallons of water per ounce.

Pork, while requiring more water than chicken, is also preferable to beef. Want a compromise? Try making meat a side dish instead of your main, and load up on grain and veggies.

**Speaking of veggies, if you're a vegetarian, you might think that you have nothing to worry about. But, in truth, the crops we all love (fruits, nuts, and vegetables) all come from California, too**, and plant-based proteins like beans aren't exactly innocent when it comes to water usage. Chickpeas and lentils clock in shockingly high at over seventy gallons per ounce of food. A good alternative would be choosing dark green vegetables like spinach and broccoli, or whole grains like quinoa and amaranth. Luckily, some foods we love are relatively harmless from a water consumption standpoint. Carrots, pineapples, spinach, tomatoes, strawberries, and others all fall on the thumbs-up list.

**That brings us to drinks**. Unfortunately, it might also be time to curtail your intake of that beloved California vintage. **A bottle of wine takes 56 gallons of water to produce, which is more than any other beverage, including beer**. So, if you have the choice between the two, drink beer instead.

**Okay, so, less meat, less wine, and more beer**. What else? Well, not to throw too much at

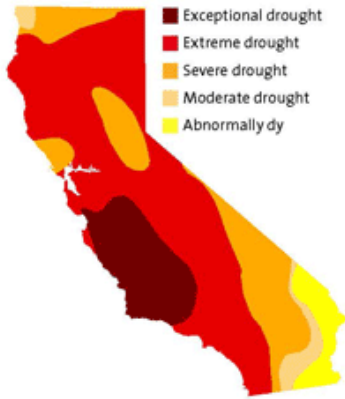
you at once, but we also need to waste less. This infographic, which recently appeared in *The Guardian*, points out that, "To meet demand, the world needs to produce more food and waste less so that the total available is 70 to 100% greater by 2050." To give some context to that figure, according to the *Plant Physiology* journal, "It took some 10,000 years to expand food production to the current level of about 5 billion tons per year. By 2025, we will have to nearly double current production again."

When taken together, these two infographics show that starting now, we'll have to produce more food using less water, and decrease our waste. It might seem like a daunting task, but little changes in our individual habits can lead to big collective results. Here is what I am committing to do: I am going to cook at home whenever possible, bring my lunch to work, and eat out less. (This of course sounds really hard. But a recent report revealed that people can spend \$11K to \$20K+ per year on Seamless without even realizing it.) When it comes to food waste, I promise to love my leftovers, not just throw them away, and I'm going to learn how to put old food to good use. That's my individual contribution, and it's nothing excessive or dramatic. So, what's yours going to be?

# Where Does Your Food Come From?

California's drought affects the whole country's fruits, veggies, and nuts.

Percentage of Total US Production by County



Crop maps based on 2012 figures. Data: US Drought Monitor, California Department of Food and Agriculture, US Department of Agriculture. Art: US Drought Monitor, Wikimedia Commons.

Mother Jones

*This story originally appeared on Mother Jones and is reproduced here as part of the Climate Desk collaboration.*

California, supplier of nearly half of all US fruits, veggies, and nuts, is on track to experience the driest year in the past half millennium. Farms use about 80 percent of the state's "developed water," or water that's moved from its natural source to other areas via pipes and aqueducts.

As the maps above show, much of California's agriculture is concentrated in the parts of the state that the drought has hit the hardest. For example: Monterey County, which is currently enduring an "exceptional drought," according to the US Drought Monitor, grew nearly half of America's lettuce and broccoli in 2012.

When it comes to water use, not all plants are created equal. Here's how much water some of California's major crops require:

# How Thirsty Is Your Food?



One head of broccoli 5.4 gallons of water



One walnut 4.9 gallons of water



One head of lettuce 3.5 gallons of water



One tomato 3.3 gallons of water



One almond 1.1 gallons of water



One pistachio 0.75 gallons of water



One strawberry 0.4 gallons of water



One grape 0.3 gallons of water

Figures indicate how much water it takes to bring each crop to maturity in the US, if using only irrigated water. Data: Mekonnen, M.M. and Hoekstra, A.Y., "Water footprints of derived crop products (1996-2005)". Art: Nikiteev\_Konstantin, Asya Alexandrova, Igor Zakowski/Shutterstock; Kate Vogel/Noun Project.

Mother Jones

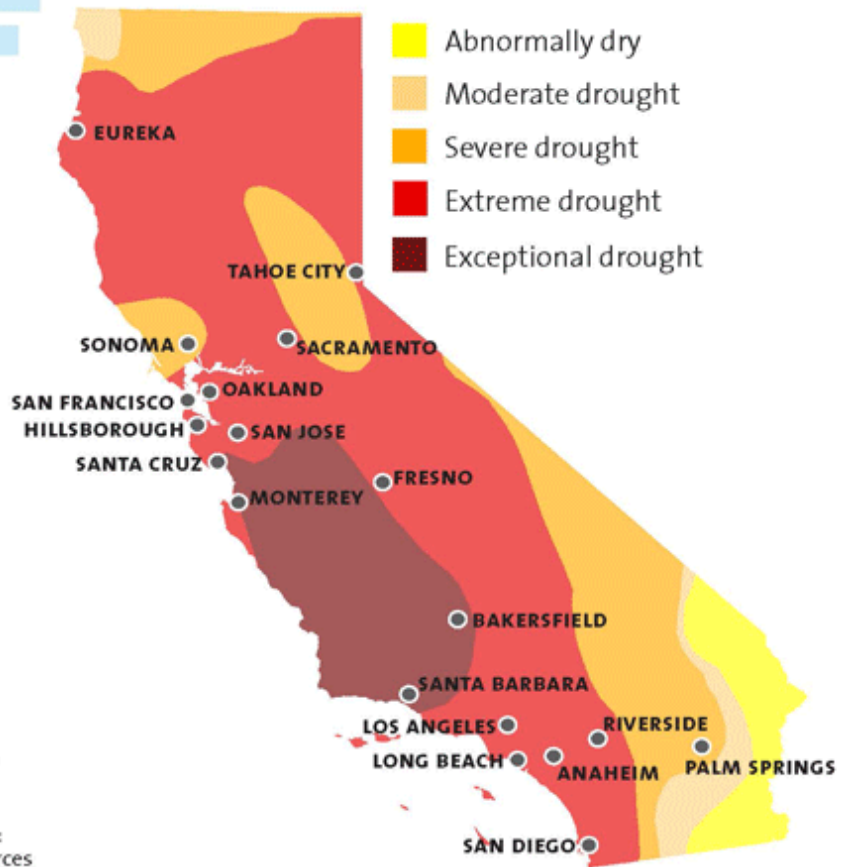
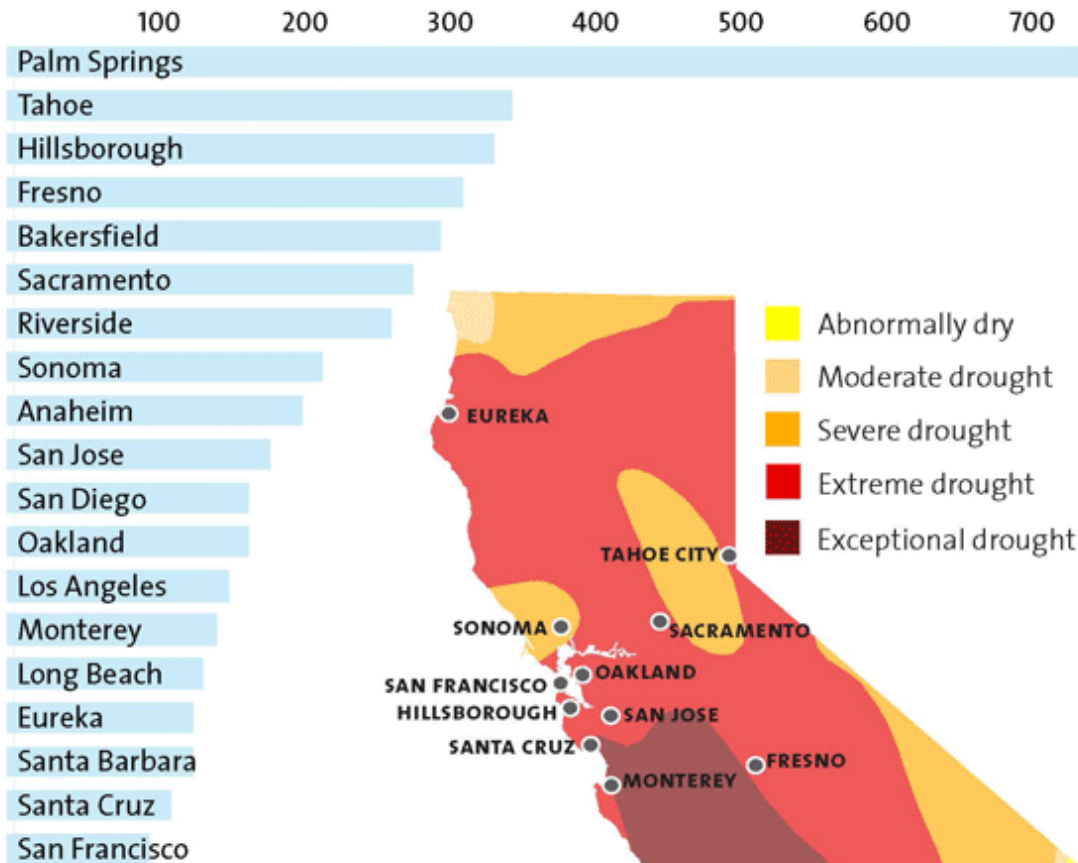
Jay Lund, a water expert at the University of California-Davis, says that water problems mean that agriculture may soon play a less important role in California's economy, as the business of growing food moves to the South and the Midwest, where water is less expensive. Production rates for thirsty crops like alfalfa and cotton have already diminished significantly in the last few years. Between 2006 and 2010 alone, the amount of land irrigated for cotton fell by 46 percent.

In addition to farms, the drought affects municipal water supplies. There is so little water this year that some places are in danger of **running out**—and the little that is left could soon become undrinkable because of the high concentration of **pollutants**.

So how are Californians doing on water conservation? Here's how some cities stack up:

# How Much Water Are California Cities Using?

Gallons of water used per person per day, not including water used for agriculture



Per capita water usage for each city is based on the city's water supplier's per capita usage in 2010.

Source for per capita water usage data: California Department of Water Resources Urban Management Plan, 2010; source for drought map: US Drought Monitor, author: David Miskus.